Aquatic Habitat Inventory of the Missouri River from Gavins Point Dam to Ponca State Park, Nebraska

by

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INTRODUCTION

One of the few reaches of the Missouri River which remains in a relatively natural free-flowing state is a 93 km segment extending from Gavins Point Dam to Ponca State Park, NB. This reach of the river was designated as a National Recreational River (P.L.95-625, Sect. 707, 1978) because the natural and cultural values of this section were considered worthy of preservation. Early in 1979, the Secretary of the Interior designated the Heritage Conservation and Recreation Service (HCRS) as the agency responsible for developing a management plan for the Missouri Recreation River. The HCRS teamed with the U.S. Army Corps of Engineers in acquiring data and formulating alternative plans for the Gavins Point to Ponca State Park segment of the Missouri River. Coordination with interested federal and state agencies (Nebraska and South Dakota), local organizations and the private individuals was incorporated into this effort. Eventually a management plan was promulgated outlining numerous objectives which are commensurate with the general tenets of the National Wild and Scenic Rivers Act.

Among the plan objectives are the following:

1) Maintain and enhance fish and wildlife populations, both game and nongame species, through maintenance and enhancement of the habitat.

2) Conduct a natural resource inventory.

Both of these objectives require data on the habitat types which currently exist in the Recreational River corridor. Consequently the decision was made to initiate a study to determine the existing habitats. A contract (#DACW 45-80-C-0155) was awarded to the

Biology Department of the University of South Dakota to conduct an aquatic habitat inventory and this report details the results of that study.

Two earlier studies (Schmulbach et al. 1975, Kallemeyn and Novotny 1977) defined the aquatic habitat types and the fish communities which characterize those habitats. In this report the terminology and criteria used to describe Missouri River aquatic habitats were generally adopted from the previous studies, particularly the study by Kallemeyn and Novotny (1977), which identified seven principal habitat types in the unchannelized river and included empirical data on depth and current velocity for each habitat.

METHODS AND MATERIALS

Excellent color aerial photographs for the entire 93 km of the river were available for our use. These photographs taken on 11/15-16/1979 proved to be invaluable in determining the general boundaries of the aquatic habitats present during the summer of 1980. The photographs exhibited considerable clarity using a scale of 1"=1000' (1:12,000).

We used two approaches in this study. During the first three weeks, our principal goal was to establish the validity of using aerial photos to visually determine habitat types. This was accomplished by comparing habitat assessments made visually from aerial photos with assessments made from empirical data, our so-called ground truth.

Ground truth was secured by a team of biologists using general surveying equipment, including an engineer's transit (Brunson Model 644211), tripod, range poles, stadia rods, CB radios, and a nonmetallic tape measure. Water depths were measured with either a range pole or with a sonic depth finder (Lowrance Model LFP-300). Current velocities were determined with either a Price current meter (Gurley Model 622, type AA) or a pygmy current meter (Gurley Model 625). In water deeper than 1.5 M, current velocities were taken at both 20 and 80% of the depth, 0.2D and 0.8D, respectively. In water $<$ 1.5M deep a single current velocity was taken at 60% of the water's depth (0.6D). All current velocities are expressed as cm/sec.

Two sites were selected for comparing ground truth information with that derived visually from color photographs. The first site was located at Clay County Park, river mile (RM) 781; the second at

the High Line Landing, RM 787-788. The procedure used at each site was similar and is described in the following paragraphs.

A prominent shoreline structure at each site was identified on the aerial photograph and then located on the ground. The transit was leveled and positioned at or near this structure and a stake was driven into the shoreline at this point which became the transect base point. The transit was then zeroed to magnetic north after which a transect line (azimuth) was established across the entire width of the river. Normally, this transect line was established at approximately a 90°∠ to the shoreline but because of river bed sinuosity, it was occasionally necessary to deviate from this procedure. Then a team of biologists waded or boated along the transect line noting habitat changes as they occurred. At each habitat border and mid-point, a distance estimation from the base point was secured using the transit and range poles or stadia rods. Where the river's width was great we moved the transit to an intermediate point to complete the transect survey. At each habitat midpoint, depths and current velocities were noted. Communication was accomplished using hand-held citizen-band radios.

After completing the initial transect line, a new transect base point was selected approximately 500-1000 feet upstream or downstream at another prominent structure or shoreline feature. An azimuth and the distance to the new transect base point was determined. Then the transit was moved to the new base point, leveled and a back azimuth established to the old base point. A second transect line was then established across the river at approximately a 90°∠ to the shoreline. The distance to habitat borders and mid points along the transect line were determined as

previously described. Nine transects were completed at each site.

From these transect data we constructed a habitat map on mylar using the same scale as the aerial photographs, 1" = 2000 ft. The mylar sheet constituted an overlay which was placed on the aerial photograph of the site so that habitat outlines on the map and the photograph could be visually compared. The habitat outlines constructed from transect data agreed reasonably well with those which we subjectively outlined on the aerial photographs.

Since the transect method was time consuming, we decided to complete the aquatic habitat survey using the aerial photographs as our principal means of defining the habitat areas. However, we still wanted ground truth observations to verify the photograph interpretations. Consequently, we xeroxed copies of the color photographs so that we could draw habitat outlines, record depths, current velocities, etc. directly onto these copies in the field. The copies lacked definition but the original photographs were also available as a team of two or three biologists traversed the entire river distance in a boat. In general, we covered 6-10 km per day. We stopped at numerous locations to measure depth, current velocity and estimate the width and length of the habitats. In most instances the location of habitats was similar to that depicted in the color photographs. However, whenever differences were observed they were recorded on the xeroxed copies of the photographs.

Water releases from Gavins Point Dam during the period when the habitat survey was conducted, June through July 1980, averaged 31,492 cfs and ranged between 26,000 and 35,600 cfs. The habitat

assessment survey was completed before the end of July but we continued to monitor changes in riverine habitats throughout the late summer, fall and early spring of 1981.

After the habitat types were marked on the xeroxed sheets they were assembled into a composite map of the entire Missouri River recreational area and taped onto a continuous sheet of kraft paper. The area of each habitat type was then determined using a digital-readout compensating polar planimeter, courtesy of the Clay County Office of the Soil Conservation Service. The areas from which the tabular data were constructed represent the average of two separate determinations for each individual habitat type.

The last step was the preparation of a final composite map of the aquatic habitats of the recreational river corridor. Large mylar sheets were placed over the xeroxed aerial photographs upon which the habitat areas had been outlined in pencil. The mylar sheets were taped together and secured to the composite map of xeroxed sheets. The outline of the river and its various habitats were then traced onto the mylar. To facilitate separation of the various habitats, each habitat type was color coded. Felt tipped marking pens were used to color each habitat. The mylar map composite was subsequently sprayed with several coats of a water-proofing material (Tuffilm, M. Grumbacher, Inc.).

The criteria used in identifying the habitat types generally followed those established by previous workers (Schmulbach et al. 1975, Kallemeyn and Novotny 1977) although a few modifications were used. We considered that there were eight principal habitat types in the unchannelized river which were defined as follows:

I. Main Channel - That portion of the river bed where the water depth >1.5 M and current velocity >50 cm/sec. We included the tailwaters of Gavins Point Dam as Main Channel habitat for convenience only since there is considerable evidence that this artificial environment has a unique and concentrated fish community (Schmulbach et al. 1975).

II. Main Channel Border - That portion of the river bed adjacent to the bank and bordered by the main channel was considered as Main Channel Border. It frequently contains inundated trees. We considered the average width of this habitat to be 9.1 M although it varied from 6.1 to 15.2 M in width. Man-made bank protection structures such as revetments, hard points, etc. were included in this habitat but they were listed as a separate subcategory because of substrate differences.

III. Chute - All subsidiary channels were classified as chutes. In general chute depths were <2.0 M with mean current velocities <75 cm/sec. Parts of the main channel which were in a transitory stage were arbitrarily placed into the Chute habitat but are listed as a separate subcategory, Old Main Channel, in the table.

IV. Pool - This habitat represents the holes which develop downstream of sandbars and are generally characterized by water depths >1.5 M and current velocities <50 cm/sec. This habitat is extensively utilized by several species of fish which are members of the big river assemblage of Pflieger (1975) such as the paddlefish and shovelnose sturgeon.

V. Confluence of Tributary Streams - This habitat type is self explanatory and is generally characterized by the existence of eddy currents, a deep depression and the mixing of more turbid tributary waters with the less turbid waters of the Missouri River. Only two principal tributaries, the James and Vermillion Rivers, enter the Missouri River in the recreational river corridor.

VI. Sandbar - All areas of the river where the water depth was $<$ 1.5 M and the current velocity $>$ 10 cm/sec were categorized as sandbar habitat unless it had a well defined channel whereupon it was called Chute habitat.

VII. Backup - Marsh - For convenience we combined the Backup and Marsh habitat of previous studies (Schmulbach et al. 1975, Kallemeyn and Novotny 1977) into a single habitat type although we listed both types as subcategories. Both subcategories have no measurable current velocity but Marshes usually are shallow ($<$ 1.0 M) and have considerable emergent vegetation distributed throughout the area encompassed by the Marsh. Backups represent Chutes whose upstream end has been cut off from the rest of the river. Water backs into these areas from the downstream connection to the river. Emergent macrophytes such as cattails line the margin of this habitat subcategory.

VIII. Oxbow - Puddle - This habitat was the last aquatic habitat type included in the inventory. This habitat is completely separated from the other riverine habitats. Indeed, the Oxbows were located above the normal high water marks of the river

although still within the flood plain and usually within the recreational river corridor. Burbank Lake, the largest Oxbow in the flood plain, was located outside the corridor. Oxbows are remnants of the old river channel which were separated from the main body of water by a shift in the location of the river bed. Most oxbows are formed during major floods. Since major flooding is controlled by the mainstem dams of the Missouri River, no new oxbows are expected to be created in the immediate future. Puddles are defined as small, shallow water-filled depressions in otherwise terrestrial environments. They are not connected to the river proper and were found on terrestrial sandbars, islands and in old chutes and backups which are no longer connected to the river. The remaining habitats, Terrestrial Sandbars and Islands, were included in the survey although they are not presently aquatic habitats. However, during periods or seasons of high flow rates, parts or entire segments of these habitats would be inundated.

RESULTS

Two composite maps were constructed from the data collected during this survey. One map consisted of xeroxed copies of the aerial photographs that were pieced together to form a composite map of the Missouri River recreational corridor. Individual habitat type were previously penciled onto the xeroxed copies after on-site inspection of the habitats. This composite map was taped to a continuous sheet of kraft paper and is separately appended to this report.

The second map was a composite map traced onto mylar sheets using the first map as a template. In this map the various habitat types and subtypes were color coded to facilitate their recognition. This map is also separately appended to this report.

The location of the habitats in this section of the Missouri River should be considered as transitory. The river bed is a dynamic entity and even before the survey was completed some of the habitats previously located had disappeared, changed shape, or changed position. This was especially true for sandbar and pool habitats which are constantly being degraded and formed. None-the-less we believe the total area encompassed by the various habitats remains fairly constant even though individual habitats are constantly changing. Consequently, the areas determined for each habitat type are probably realistic estimates of what exists in the recreational river corridor at this time.

We estimated that the total area of the river between the normal high water marks of the river was 7,366.55 ha (Table 1). The eight

Table 1. Aquatic and terrestrial habitat areal determinations in the Missouri River recreational corridor, Gavins Point Dam to Ponca State Park, Nebraska, June - July 1980. Includes all areas between the normal high water marks of the river except oxbows, where all oxbows in the flood plain are included. Mean current velocities and maximum depths taken during the study are also included. Ranges are indicated by ( ).

Habitat Type	Area ha/a	Total area %	Maximum Mean Depth (m)	Mean current velocity cm/sec	No. obs.
Aquatic					
I. Main channel	2,876.64/7,108.18	39.05	3.78(1.68 - 9.1)	0.2D=109.8(57- 163.8)	63
				0.8D= 84.4(45.1-158.2)	63
II. Main channel border	132.02/ 326.24	1.79	2.71(1.52- 4.57)	0.2D= 68.4(29.0-118.7)	13
a) MCB - proper	109.12/ 269.65			0.6D= 45.1(34.4-57)	2
b) Revetments, etc.	22.9/ 56.59			0.8D= 54.3(23.5-92.8)	13
III. Chute	273.78/ 676.5	3.72	1.81(0.61- 4.57)	0.2D= 66.4(8.9-101.8)	13
a) chute proper	231.67/ 572.45			0.6D= 54.1(23.5-84.7	16
b) Old Main Channel	42.11/ 104.05			0.8D= 61.2(4.6-95.9)	13
IV. Pool	205.99/ 509.01	2.8	2.5(1.22- 5.18)	0.2D= 42 (6.7-90-5)	37
				0.6D= 38.2(17.8-78.9)	8
				0.8D= 36.4(4.6-73.5)	37
V. Confluence of Tributaries	3.46/ 8.54	0.04			
VI. Sandbar	1,951.9/ 4,823.14	26.5	0.77(0.12- 1.52)	0.6D= 59.4(11.1-102.5)	33
VII. Backup - Marsh	61.21/ 151.26	0.83	1.8 (.91- 3.66)	no current	
a) backup	49.76/ 122.97				
b) marsh	11.45/ 28.29				
VIII. Oxbow - Puddle	27.5/ 67.96	0.37			
a) oxbow	18.0/ 44.48				
b) puddle	9.5/ 23.48				
Total Aquatic	5,532.5/13,670.81				
Terrestrial					
IX. Sandbar	889.62/2,198.28	12.02			
X. Islands	944.42/2,333.67	12.81			
Total Terrestrial	1,834.05/4,531.95				
Total Area	7,366.55/18,202.75	100			

aquatic habitats constituted 5,532.5 ha which included 18 ha of oxbows outside the normal high water marks. The Main Channel habitat encompassed 2,876.64 ha and constituted 39.05% of the total area. The second most abundant habitat type was Sandbar, 1,951.9 ha and 26.5% of the total area. The only other aquatic habitats which comprised significant amounts of area were Chutes, 273,78 ha and 3.72%, and Pools 205.99 ha and 2.8%. The Main Channel Border habitat was widely distributed throughout the corridor but constituted only 132.02 ha and 1.79% of the total area.

Backup - Marsh habitat was limited to 61.21 ha and 0.83% of the total area. This habitat has declined since completion of the main stem dams on the Missouri River. Presumably this is the result of stream bed degradation which has dropped the elevation of the river bed more than one meter in the recreational river corridor (U.S. Army Corps of Engineers 1977). Morris et al. (1968) and Volesky (1969) estimated that marsh and backup habitat constituted approximately 5% of the area of the Missouri River between the high water marks. Their estimates were based on aerial photographs which had less clarity than those we used. Moreover, they probably included some chute habitat that was lined with cattails and other emergent macrophytes. Never-the-less it is obvious that the major aquatic habitat change which has occurred in the Missouri River since the late 1960's has been the decline in the amount of Backup-Marsh habitat present in the river. Since this habitat is the major producer of benthic macroinvertebrates as well as many species of fish, its loss is significant for the entire ecosystem (Morris et al. 1968, Volesky 1969, Kozel 1974, Schmulbach 1974, Groen and Schmulbach 1978, Schmulbach et al. in press).

Terrestrial Sandbars (889.62 ha and 12.2%) and Islands (944.42 ha and 12.81%) were the principal terrestrial habitats in the recreational river corridor between the high water marks. Terrestrial Sandbar habitat has probably increased in importance since the 1960's at the expense of Backup-Marsh habitat.

Depths and current velocities taken at the habitat sites were compared to those recorded by Kallemeyn and Novotny (1977). Given the wide variation in these parameters and the limited number of observations, the results of both studies were generally similar (Table 2). However, our depth measurements actually represent the mean of maximum depths and hence, are usually greater than the previous study. This was especially true in the Main Channel and Pool habitats. The differences in current velocity means of the Main Channel Border and Sandbar habitats are probably caused by chance and little significance should be attached to the absolute values.

Table 2. Comparison of mean depths and mean current velocities in various habitats of the unchannelized Missouri River.

Habitat type	Mean Depth (M) Present Study	Kallemeyn & Novotny (1977)	Current Velocity (cm/sec Present Study 0.2D	Kallemeyn & Novotny (1977)
Main Channel	3.78	2.6	109.8	110
Main Channel Border	2.71	2.3	68.4	100
Chute	1.81	1.2	66.4	40
Backup-Marsh	1.8	1.6	--	--
Pool	2.5	1.7	42	50
Sandbar	0.77	0.9	59.4	20

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LITERATURE CITED

Groen, C. L. and J. C. Schmulbach, 1978. The sport fishery of the unchannelized and channelized middle Missouri River. Trans. Amer. Fish. Soc. 107(3):412-418.

Kallemeyn, L. W. and J. F. Novotny, 1977. Fish and fish food organisms in various habitats of the Missouri River in South Dakota, Nebraska and Iowa. Washington, DC, U.S. Fish and Wildl. Serv., Office of Biol. Serv; FWS/OBS 77/25. 99 p.

Kozel, D. J. 1974. The utilization of select habitats by immature and adult fishes in the unchannelized Missouri River. Vermillion, S.D., Univ. of South Dakota. M.A. Thesis. 74 p.

Morris, L. A., R. N. Langemeier, R. Russell and A. Witt. 1968. Effects of main stem impoundments and channelization upon the limnology of the Missouri River, Nebraska. Trans. Amer. Fish. Soc. 97(4):380-388.

Pflieger, W. L. 1975. The fishes of Missouri, Jefferson City, MO. MO. Dept. Cons. 343 p.

Schmulbach, J. C. 1974. Marsh Legacy. Paper presented to Annual and National Environmental Engineering Convention of the Amer. Soc. of Civil Engineers. Oct. 23, 1974. Kansas City, MO.

Schmulbach, J. C., G. Gould and C. L. Groen. 1975. Relative abundance and distribution of fishes in the Missouri River, Gavins Point Dam to Rulo, Nebraska. Proc. S. D. Acad. Sci. 54:194-222.

Schmulbach, J. C., D. H. Tunink, and A.E. Zittel (In Press), Swimming Performance of fishes endemic to the Missouri River in South Dakota. Washington, D.C., U.S. Fish and Wildlife Services, Office of Biological Services. 107 p.

U. S. Army Corps of Engineers. 1977. Draft environmental impact statement, Missouri River, South Dakota, Nebraska, North Dakota, and Montana. Omaha, NB: Dept. Army, Missouri River Div. Mimeo. report.

Volesky, D. F. 1969. A comparison of the macrobenthos from selected habitats in cattail marshes of the Missouri River, Vermillion, S.D., Univ. of South Dakota. M.A. Thesis. 44 p.

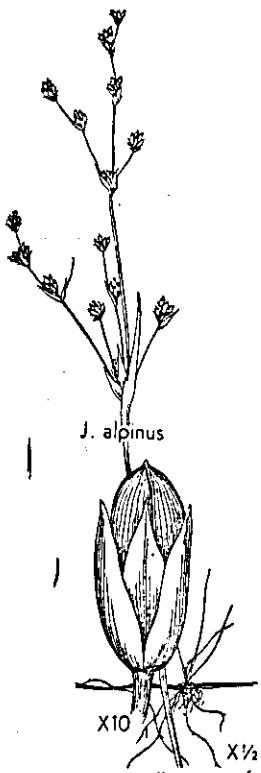
2 rare plants

willow - cottonwood

VANBRUGGEN, Theodore. 1961. An ecological and taxonomic study of a sand dune and flood plain area adjacent to the Missouri River. Proc. S. D. Acad. Sci. 40: 132-141.

In the Missouri River valley southwest of Elk Point, in Union County, SD, there is an area of travelling sand dunes slightly under 200 acres in size. This is adjacent (west) to a flood plain consisting of an area over 200 acres. Several small rivulets from the main channel enter and meander through the flood plain. Two species, Juncus alpinus Vill., a rush, and Erechtites hieracifolia (L.) Raf., a composite, apparently occur in South Dakota only on this flood plain.

NEED: Determine if the rush and composite still occur on this flood plain. If they do, take into consideration when prioritizing areas to be preserved by scenic easement.



A cosmopolitan genus of about 225 species; besides the following, several others occur in the southern and western states. Rushes should be collected in fruit, since the shape and size of the mature capsule and ripe seeds are often diagnostic. The number of stamens is also important and is easily determined by hand-lens observation in the field. In most species the stamens are persistent and may be observed by dissection of mature dried specimens. Care must be taken not to confuse the paired prophylls immediately at the base of the perianth, when present, with the bracts at the base of pedicel. Measurements of the capsule and the perianth are taken from the same point at the base of the perianth or summit of the pedicel. (The ancient Latin name for these or similar plants.)

50. **ERECHTITES** Raf. Fireweed.

Heads discoid, whitish (in ours) or dull yellow. Involucre a single series of narrow, equal, more or less herbaceous bracts, sometimes with a few minute bracteoles at the base. Receptacle flat, naked. Outer flowers pistillate, filiform-tubular, eligulate, in 2-several series; inner flowers hermaphrodite but sometimes sterile, the corolla narrowly tubular, 4–5-toothed; anthers entire or slightly sagittate at the base; style-branches flattened, truncate or with very short hairy appendages. Achenes 5-angled or 10–20-nerved. Pappus of numerous slender bristles. Erect annual or perennial herbs, with alternate, entire to pinnately dissected leaves and cylindric to ovoid heads.

About a dozen species, native to America, Australia, southeastern Asia, and adjacent islands. The following typical one is the only species native to North America north of Mexico. (Name given by Dioscorides to some groundsel.)

1. Erechtites hieracifolia (L.) Raf. Fibrous-rooted annual weed 0.1–2.5 m. tall, glabrous or sometimes more or less spreading-hairy throughout, the stem erect, striate, and slightly succulent. Leaves of various sizes up to sometimes 20 cm. long and 8 cm. wide, sharply serrate with callous-tipped teeth, sometimes also irregularly lobed, the lower oblanceolate to obovate, tapering to a short petiole or petioliform base, the middle and upper becoming elliptic, lanceolate, or oblong, and, especially in robust specimens, often auriculate-clasping. Heads several or numerous in a flat-topped or elongate inflorescence, or in depauperate plants often solitary, turbinate-cylindric, with somewhat swollen base when fresh; involucre about 1–1.5 cm. high, the bracts glabrous or finely strigose, green with pale margins, striate, attenuate to merely acutish, commonly 0.5–2 mm. wide; denuded receptacle commonly 5–8 mm. wide. Achenes about 2–3 mm. long, finely strigose between the mostly 10–12 ribs, provided with a white annular ring at the summit, from which the base of the style may occasionally project as a minute beak. Pappus copious, bright white, eventually deciduous.

Various habitats, including dry woodlands, marshes, and waste places, often becoming especially abundant after fires, Nf. to Fla., w. to Neb. and Tex., south through Mexico and the West Indies to S. Am.; introduced in Europe. Aug., Sep. The var. *megalocarpa* (Fern.) Cron., a well-marked ecotype of saline coastal marshes from Mass. to N. J., differs from the typical variety as described above, in being fleshy, with slightly larger heads that are more conspicuously swollen at the base (the denuded receptacle commonly 9–12 mm. wide), and especially in its larger achenes, these commonly 4–5 mm. long, 16–20-ribbed, and often glabrous. Intermediates occur.

old stands

elm-oak

LAWREY, J.D., W. Winner, G.R. Hoffmon, and T. VanBruggen. 1973. A basic ecological study of floodplain and upland vegetation along the Missouri River from Yankton, South Dakota to Rulo, Nebraska. Univ. S.D., Vermillion. 102 pp.

Old stands of upland deciduous forest adjacent to the flood plain of the Missouri River are rare. Those which do occur represent perhaps several hundred years of development and evolution. If they are removed, they will not again be present for many generations, or may never be present again. These old forests are living museums of what part of our landscape looked like before the advent of European man. They are irreplacable and they offer a unique grouping of plants (and animals) that should be preserved for future generations who no doubt will be seeking answers to questions the current generation is yet too ignorant to ask.

NEED: Determine where old stands of upland deciduous forest exist in the corridor. Monitor stands; and in the event of progressive disturbance to them, seek an interest in the property via scenic easement.

non-MNRR recommendations

Cottonwood-willow / willow-cottonwood

Siouxland Interstate Metropolitan Planning Council. 1978. Missouri River Woodlands and Wetlands Study. SIMPCO, Sioux City, Iowa. 70 pp.

Results from Summary Table A show that between 1956 (the year following closure of Gavins Point Dam) and 1975, 6,830 acres of woodland were converted to agricultural uses. During this same time period 930 acres of woodland were lost to erosion by the river. The greatest woodland to farmland conversion occurred in the flood plain defined by the U.S. Geological Survey quadrangles: Menominee, St. Helena, and Maskell. The greatest losses of woodland and farmland to river erosion occurred in the flood plain defined by the USGS quadrangles: Maskell, Burbank, and Ponca. The authors define woodlands as either a continuous canopy of established trees or a less continuous canopy of trees with open areas.

NEED: The trend of woodland conversion to farmland is expected to continue. Thus, there is an urgent need to preserve cottonwood-willow and willow-cottonwood habitat in the MNRR by scenic easement, especially in the Menominee, St. Helena, and Maskell quadrangles. Scenic easements from willing sellers of unproductive farmland outside the MNRR corridor boundary should also be sought.

Summary Table A. Change Acreages

	Quadrangle	WD-A	R-WT	S-WT	S-R	S-WD	WD-R	WT-WD	WT-A	A-C	A-R	S-A	WT-R	A-WD	WD-C	A-WT	R-A	R-WD	R-C	WD-WT	C-R	S-C	WT-C	Change Acres	Study Area Total
Upper Reach 80 miles	Gavins Point Dam	613	60	102	0	72	0	38	63	80	5	17	36	31	36	0	0	5	0	0	0	7	3	1,168	6,824
	Menominee	1,054	259	132	268	156	0	162	95	0	10	52	5	15	0	0	0	0	0	0	0	0	0	2,208	7,781
	St. Helena	1,436	113	306	611	106	25	8	0	0	33	51	0	121	0	20	0	0	0	0	0	0	0	2,830	11,309
	Meckling	487	168	231	213	0	79	40	0	0	12	0	0	3	0	0	0	0	0	0	0	0	0	1,233	7,479
	Vermillion	473	220	110	105	51	39	40	108	0	0	46	8	0	0	0	0	0	0	0	0	0	0	1,200	3,037
	Maskell	1,019	445	294	186	198	240	42	8	0	315	62	50	0	0	0	11	0	0	0	0	0	0	2,870	7,636
	Burbank	879	1,563	203	283	50	276	82	53	0	144	0	17	119	0	70	0	0	0	0	0	0	0	3,739	9,833
	Elk Point	331	847	143	95	51	88	0	0	63	84	0	7	0	0	88	0	0	0	0	0	0	0	1,797	7,709
	Ponca	530	918	155	42	82	183	0	0	0	119	135	39	19	0	42	0	0	0	0	0	0	0	2,272	7,794
	Jefferson	1,287	838	264	0	15	0	105	154	0	0	54	21	25	0	0	0	0	0	0	0	0	0	2,763	8,406
	Jackson	398	191	58	0	29	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	688	2,010
Lower Reach 57 miles	Sioux City South	1,274	535	119	13	96	45	44	83	658	22	8	8	31	108	0	3	13	122	0	34	0	0	3,300	13,996
	Homer	1,811	688	105	8	112	177	0	178	16	3	280	5	16	84	23	110	12	0	83	0	0	0	3,711	6,934
	Salix	420	949	0	0	6	27	29	83	73	87	59	111	14	179	0	87	0	0	0	0	0	0	2,124	6,782
	Albaton	2,166	1,532	88	93	299	0	179	37	0	0	0	177	58	0	0	0	0	0	0	0	0	0	4,629	11,165
	Macy	2,100	908	179	225	137	0	32	34	7	63	34	37	0	0	0	0	29	0	0	0	0	0	3,785	7,153
	Onawa, SW	1,135	631	293	0	52	5	116	72	32	20	0	0	6	0	6	0	35	0	0	0	0	0	2,403	4,649
	Tekamah, NW	1,846	1,521	0	112	257	109	204	46	0	35	0	107	123	0	0	13	0	0	0	0	0	0	4,373	13,236
	Tekamah	213	33	0	0	0	0	7	32	0	0	21	0	0	0	0	0	0	0	0	0	0	0	306	1,297
	Little Sioux	1,741	569	0	0	173	108	190	143	40	16	0	76	33	0	0	18	49	0	0	0	0	0	3,156	10,053
	Total	21,221	12,968	2,782	2,254	1,942	1,405	1,330	1,189	969	968	819	704	614	487	249	242	143	122	83	34	7	3	50,555	155,082

SOURCE: Empirical data developed as part of this study, June 1978.

erosion finding

erosion finding

scenic finding

scenic finding

U.S. FISH AND WILDLIFE SERVICE. 1979. Planning aid letter to Omaha District Corps of Engineers dated March 21, 1979. Pierre Area Office, SD. 9 pp.

Acres of habitat losses in the Missouri River and along bands approximately 0.5 miles wide on both sides of the river from 1944 to 1977: cottonwood-dogwood 5,331, willow-cottonwood 97, sand dune 2,606, elm-oak 127. Remaining acres of habitat as of 1977 are: cottonwood-dogwood 6,012, willow-cottonwood 4,478, sand dune 868, elm-oak 829. Agricultural acres increased from 7,907 in 1944 to 12,849 in 1977. Agricultural encroachment is the primary cause of the loss of cottonwood-dogwood, willow-cottonwood, and elm-oak habitat. Between 1974 and 1977, sand dune acreage increased by 30 acres. This was probably the result of low lying lands having large quantities of sand deposited on them during abnormally high water releases in 1975.

NEEDS: Sand dune habitat appears to be the terrestrial habitat in most danger of disappearing from the MNRR corridor because of its current low volume. Scenic easements should be obtained on as much sand dune habitat as possible. Future high releases should be monitored to determine if there is a significant relationship between high releases and sand dune habitat gain.

CLAPP, James R. 1977. Wildlife Habitat Evaluation of the Unchannelized Missouri River in South Dakota. M.S. Thesis. S. Dak. State U., Brookings. 114 pp.

In 1977, sixty percent of the corridor was occupied by agricultural or urban developments. The remaining area was composed of six habitat types: sand bar, sand dune, cattail marsh, cottonwood-willow, cottonwood-dogwood, and elm-oak. Each habitat provides a set of life requirements to which certain faunal groups are adapted more to than other habitats. The diversity of vegetational life forms which grow in the six habitats enable a variety of faunal groups to exist. The loss of any of these habitats would result in the reduction or elimination of those species utilizing them.

NEED: In the development of the MNRR Implementation Plan, plan with a specific objective of maintaining areas of all six of these habitats to preserve the diversity of wildlife found in the corridor.